REMARKS

Applicant's attorney wishes to thank Examiner Barry for the courtesies extended during the telephone interview of January 30, 2004.

Claims 1-4 and 9-15 currently appear in this application. The Office Action of October 6, 2003, has been carefully studied. These claims define novel and unobvious subject matter under Sections 102 and 103 of 35 U.S.C., and therefore should be allowed. Applicants respectfully request favorable reconsideration, entry of the present amendment, and formal allowance of the claims.

Claims 1-4 and 9-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Logan in view of Yokomori.

This rejection is respectfully traversed. Logan teaches removing perchlorate and chlorate from contaminated water using bacteria that reduce chlorate to chloride. These bacteria require nutrients such as nitrogen, phosphorus, and carbon dioxide and various other carbon sources, such as phenol. In fact, Logan teaches away from the present invention, stating that nitrate reduction results in the formation of nitrite intermediates which can accumulate in the water. In contrast, reduction of perchlorate and chlorate has surprisingly been found to not result in the accumulation of toxic intermediates such as chlorite (column 2, lines 44-49).

It is clear from this description of the formation of nitrites that the bacteria of Logan are not at all the same as those of the present invention.

The autohydrogenotrophic bacteria of the present invention are described in detail on page 10 of the specification as filed, beginning at the penultimate paragraph. The hydrogen-oxidizing denitrifying (HOD) bacteria obtain their energy by oxidizing hydrogen gas and coupling that to nitrate reduction, as shown in Figure 1. The end products of the HOD process are water and nitrogen gas, which are harmless and inconsequential from the perspective of a drinking water supply, as is the small amount of hydrogen that can dissolve in water. Many of these bacteria are autotrophic, which means that they use carbon dioxide as a carbon source for growth.

One skilled in the art can readily, without undue experimentation, determine if a microorganism is an HOD bacterium by growing the isolate on HOD medium in the presence of hydrogen. Development of turbidity accompanied by a loss of nitrate is a positive result of HOD capacity. Tables 1 and 2 show characteristics of some HOD bacteria isolated and kinetics of hydrogen uptake by cultures of these bacteria.

Logan is limited to removing perchlorate and chlorate from water, leaving chloride as the product. The

product of the reaction of the present invention, however, is nitrogen, which, as a gas, is readily released from the treated water and leaves no residue. As stated above, Logan notes at column 4, lines 43-47, that nitrate reduction, however, results in the formation of nitrite intermediates which can accumulate in the water. Therefore, there is no suggestion in Logan to use the microorganisms disclosed there in a process to remove nitrate from water, as Logan admits that nitrite intermediates are formed, which are undesirable.

Yokomori et al. add nothing to this, because Yokomori et al. merely disclose a method of culturing bacteria to produce lysine, and that ammonium nitrate is a conventional nitrogen source for bacterial reactions. There is nothing in Yokomori et al. that would suggest that the bacteria cultured to produce lysine would have any effect on contaminated water.

The Examiner has cited Kaplan for the proposition that proteobacteria meet the purple, non-sulfur, phototrophic limitations of claim 2. However, as shown in the present specification at page 19, the microorganisms which meet the criteria of being HOD bacteria can be alpha-, beta-, or gamma-strains of Proteobacteria. However, as noted in the present specification at page 27, beginning at line 1, the HOD bacteria are distributed among the domains of Archaea and Bacteria, although the four identified HOD bacteria reported

in the literature belong to the Proteobacteria division of the domain Bacteria. Although the HOD bacteria do not appear to form a monophyletic group, one skilled in the art can readily identify which microorganisms are HOD, using a simple test as described above.

As disclosed in the specification at page 4, first paragraph, HOD bacteria can grow and remain active in a hydrogen-fed bioreactor even when nitrate is not present and even after oxygen has been removed. This is particularly useful for a small bioreactor that is not in constant use, as they do not require a minimum concentration of nitrate to function.

Both Gearheart and Frankenberger disclose bacteria that reduce perchlorate and nitrate. However, it should be noted that Logan cautions against using bacteria for nitrate reduction because of the formation of nitrite intermediates, which can accumulate in the water. Gearheart notes that GR-1, the strain disclosed in Logan, is not sufficient for removing both perchlorates and nitrates, and thus discloses using a mixed bacterial culture.

It is noted that claim 14 is merely objected to as being dependent on a rejected base claim, but would be allowed if presented in independent form. Since it is believed that

claim 1, from which claim 14 depends, is patentable, claim 14 has not been amended.

In view of the above, it is respectfully submitted that the claims are now in condition for allowance, and favorable action thereon is earnestly solicited.

Respectfully submitted,

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Annotated Sheet Showing Changes

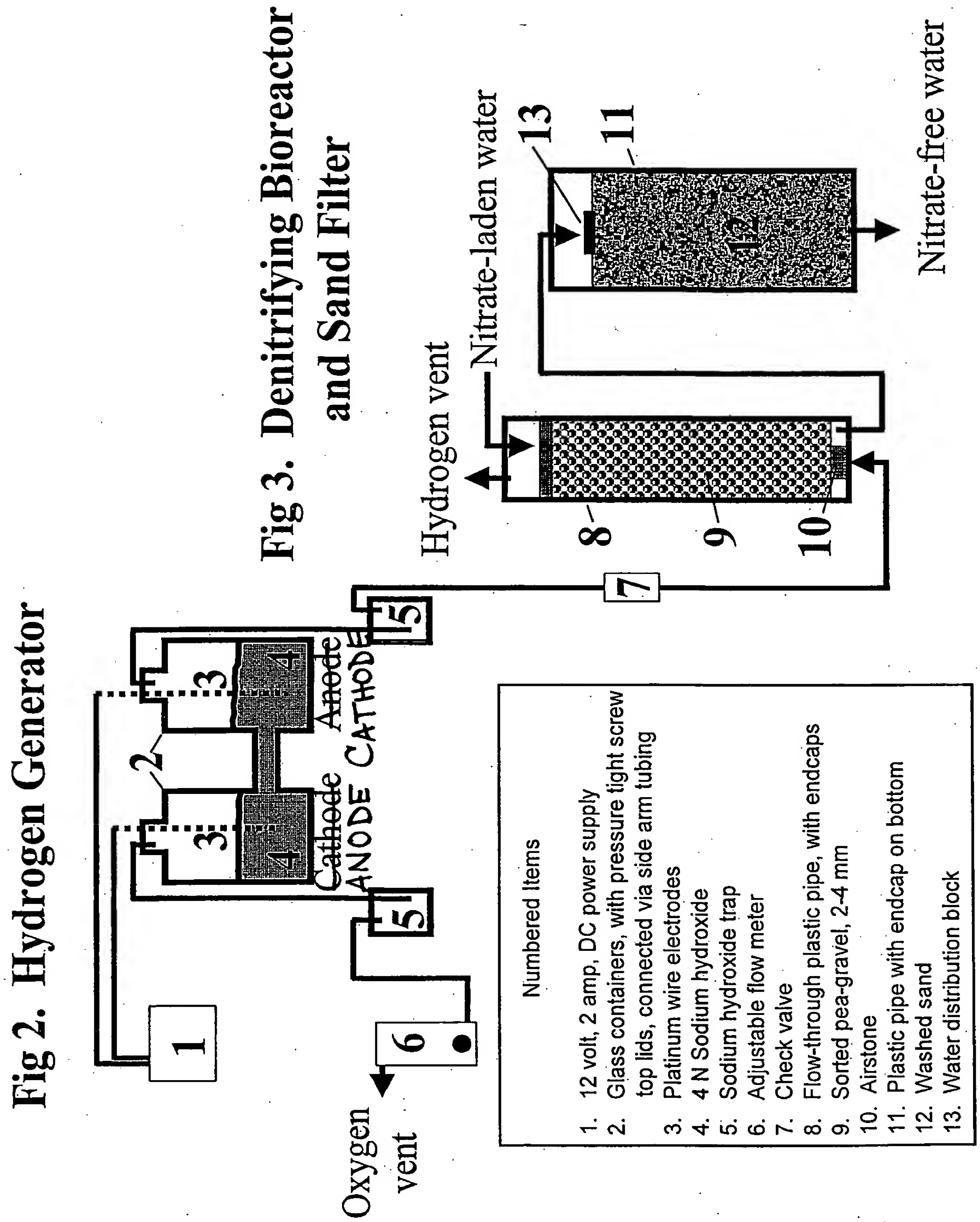

Fig 2. Hydrogen Generator

Fig 3. Denitrifying Bioreactor and Sand Filter